REMARKS

The Office Action dated January 20, 2004 has been received and carefully studied.

The Examiner newly rejects claims 1, 18-25, 35 and 40 under 35 U.S.C. §103(a) as being unpatentable over Aidman et al., U.S. Patent No. 5,376,477 in view of JP 55-024330. The Examiner states that Aidman et al. disclose a battery plate separator system with three layers in face-to-face relationship, the first and third layers including a porous mat of fibers, and a second layer between the first and third layers comprising a porous organic polymeric sheet with pores. The Examiner notes that Aidman et al. disclose two porous fibrous layers and one porous polymeric layer, and that as a result, either one of the two porous fibrous layers or the porous polymeric layer acts as the support layer, and all three have pores because they are "porous". Since Aidman et al. disclose that the separators are to be used in lead-acid batteries and are inert to the electrolyte, the Examiner considers that the layered separator system is acid-resistant. The Examiner admits that Aidman et al. do not expressly disclose that the pores are macroscopic or the specific diameter of the pores, and newly cites JP '330 for its disclosure of a battery separator mainly composed of glass fibers with a specific fiber diameter. The Examiner notes that the combination of both glass fibers having specific diameters and weight composition provides a fibrous layer having an average pore size of more than 3 μm, and that since the plate is porous, it possesses pores. The Examiner considers that the claim limitations regarding the openings having diameters larger than 50 μm and penetrating the whole thickness of the support layer providing direct ionic transfer through the support layer via straight paths extending substantially perpendicularly to the extended plane of the support are inherent in the JP '330 reference. The Examiner concludes that it would have been obvious to make the battery separator of Aidman et al. with the specific opening diameter (macroscopic pores) of JP '330.

By the accompanying amendment, claim 1 has been amended to recite that the support layer

comprises a plurality of macroscopic openings having diameters larger than 1 mm. Support for the amendment can be found on page 6, second full paragraph of the specification.

In claim 1 as amended, the lower limit of the macroscopic openings is now ten times greater than the upper limit for the hole diameter recited in JP '330. Accordingly, the combination of Aidman et al. and JP '330 does not disclose or suggest the present invention as now claimed in claim 1.

The Examiner also rejects claim 2 under 35 U.S.C. §103(a) as being unpatentable over Aidman et al. in view of JP '330 and further in view of Okada et al. Okada et al. is cited for its disclosure of a battery separator having an average pore diameter of about 3 of 7 μm.

Claim 2 is believed to be allowable by virtue of its dependence, as Okada et al. do not supply the above-mentioned deficiencies of Aidman et al. and JP '330.

The Examiner rejects claims 14-17 as being unpatentable over Aidman et al. in view of JP '330 and further in view of Waterhouse. Waterhouse is cited for its disclosure of a battery separator wherein glass fibers may be incorporated into the material having diameters less than 20 microns as the mean diameter.

Claims 14-17 are believed to be allowable by virtue of their dependence, as Waterhouse does not supply the above-mentioned deficiencies of Aidman et al. and JP '330.

The Examiner rejects claims 33 and 41 as being unpatentable over Aidman et al. in view of JP '330 and further in view of Fraser-Bell et al. Fraser-Bell et al. is cited for its disclosure of a separator assembly wherein the width of the second layer may be greater than the width of the electrode and the width of the first layer so that the separator assembly can be sealed so as to fully envelope the electrode.

Claims 33 and 41 are believed to be allowable by virtue of their dependence, as Waterhouse

does not supply the above-mentioned deficiencies of Aidman et al. and JP '330.

The Examiner rejects claims 34 and 43-44 as being unpatentable over Aidman et al. in view of JP '330 and further in view of Van Sacken, et al. (sic, Von Sacken, et al.). Von Sacken et al. is cited for its disclosure of a battery separator wherein the outer separator sections comprise a plurality of macroscopic holes greater than 1 μm in size. The Examiner notes that such holes encompass openings having a diameter greater than 1 mm (as now recited in amended claim 1).

By the accompanying amendment, claims 34 and 43-44 have been cancelled. However, this rejection will be addressed to the extent it now applies to amended claim 1.

The Examiner admits that Aidman et al. and JP '330 do not expressly disclose the openings in the support layer being macroscopic and the specific diameter of the openings. The Examiner notes that Von Sacken et al. teach separators comprising macroscopic holes greater than 1 μm in size which encompasses openings having a diameter of more than 1 mm.

Von Sacken et al. disclose a battery separator wherein the outer separator section comprises a plurality of macroscopic holes greater than 1 μm in size. As an initial matter, it is important to note that Von Sacken is not concerned with lead-acid starter batteries but rather with lithium ion type batteries, which are completely different. Indeed, it is an object of the present invention to provide a battery separator for lead-acid batteries with improved tensile strength without impairing the oxygen and ion transfer. Lithium batteries do not generate oxygen and do not comprise sulphuric acid. Accordingly, one skilled in the art looking to address the problems addressed by the instant invention would not look to the lithium battery art for solutions. Similarly, both Aidman et al. and JP '330, with which Von Sacken is combined, also relate to lead-acid batteries. One skilled in the art would not be motivated to modify the lead-acid battery separators of Aidman et al. and JP '330 based on a teaching from a reference that concerns a separator from a lithium battery.

In addition, as correctly noted by the Examiner, Von Sacken teaches that separators comprising a plurality of macroscopic holes serve as the internal shorting means of the battery. Creating an internal short with low resistance is expected to improve battery safety (column 6, lines 32-33). Upon deformation of the battery, the macroscopic holes allow contact of the battery container with the electrode (column 8, lines 39-43), thus creating an internal short which allows the energy to dissipate as quickly as possible with relatively uniform heating of the battery (column 6, lines 31-42).

In contrast, Aidman et al. disclose battery separators comprising three layers, and thus are not compatible with the objectives of Von Sacken et al., since the additional fibrous layers would prevent internal shorting, the very purpose of the macroscopic holes of the Von Sacken separators (column 8, lines 38-43). For this reason, the skilled artisan would not have combined the teachings of these documents, and would not have been motivated to modify Aidman et al. to provide the holes of Von Sacken.

Moreover, Aidman et al. teach small pores which are arranged to provide tortuous paths through the layers in order to block penetration of the separator by metallic particles, whereas Von Sacken provides holes which would allow direct contact of the battery container with the electrode upon deformation of the battery (column 8, lines 39-42). The pores of Aidman cannot be regarded as macroscopic openings. By making the pores of Aidman macroscopic and non-tortuous, metallic particles would be capable of penetrating the separator, causing the Aidman separator to fail for its intended purpose. Thus, the objectives of Aidman and Von Sacken are contradictory.

JP '330 is concerned with the provision of lead-acid batteries with a high gas-absorption factor. JP '330 suggests that sheet separators comprising a porous plate 1 and a laminated sheet composed of glass fibers. The porous sheet is characterized by a maximum hole diameter of 100 μm

and a porosity of more than 50%. Thus, the separators of JP '330 cannot solve the technical problem of Von Sacken et al. because the second layer of the separator, i.e., the laminated fibrous layer, would prevent internal shorting, which is the very purpose of the macroscopic holes of the Von Sacken separator (column 8, lines 38-43). Accordingly, one skilled in the art would have no reason to use the holes of Von Sacken in the separator of JP '330.

Even if the skilled artisan were somehow motivated to combine the teachings of JP '330 and Von Sacken, the instant invention as now claimed would not be arrived at. Specifically, Von Sacken teaches holes greater than 1 μm (column 8, line 41) while JP '330 defines the maximum hole diameter of 100 μm. Thus, a combination of JP '330 and Von Sacken at best would lead the skilled artisan to construct a separator having holes having a diameter within the range of greater than 1 μm and less than 100 μm. The skilled artisan certainly would not be motivated to have holes with diameters 10 times higher than the maximum diameter taught by JP '330.

Reconsideration and allowance are respectfully requested in view of the foregoing.

Respectfully submitted,

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